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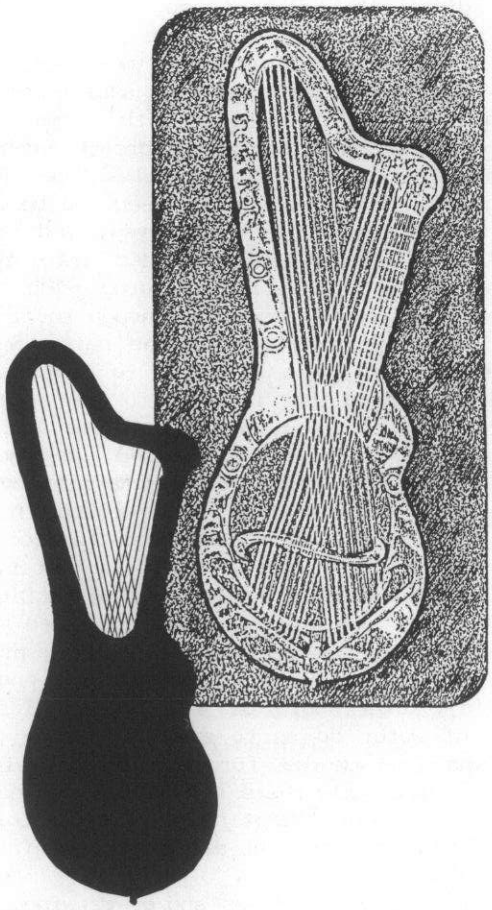
EXPERIMENTAL MUSICAL INSTRUMENTS

FOR THE DESIGN, CONSTRUCTION AND ENJOYMENT OF NEW SOUND SOURCES



Above right: Harp Guitar by William Eaton -- see page 12. (graphics from a photo by Charles Busby)

MORE SHAPES AND FORMS

Hello, readers.

In this issue we have the second and concluding part of "Shape and Form," EMI's presentation of string instruments by creative contemporary builders. Included this time are some truly beautiful guitar-like things made by Linda Manzer, Steve Klein and William Eaton. Other important articles appearing this time around are descriptions of 19-tone instruments and new keyboard designs made in the 1930s by Jim Piehl and Tillman Schafer, and, starting here on page 1, a discussion of clay percussion, exemplified by the beautiful ceramic instruments of Ward Hartenstein.

IN THIS ISSUE

SOUNDS IN CLAY

by Ward Hartenstein

Clay is one of our planet's most amazing raw materials. In its moist, plastic state it can be shaped into an infinite variety of forms; when fired to temperatures of around 2300 degrees Fahrenheit it undergoes a magical transformation, reversing the process of geological weathering as hydrated molecules of silica and alumina fuse into a glassy matrix. The result, after slow cooling, is a hard, dense, rocklike material with many unique properties, not the least incredible of which is its ability to transmit a controlled sound vibration.

The process of discovering what clay can and cannot do musically has been for me one of trial and error, intuitive guesswork, and a creative application of the principles of physics and musical acoustics. As a potter for twelve years, I have developed a fairly thorough working knowledge of the materials and processes of the craft,

(continued on page 15)

LETTERS

DEAR EMI & READERS

There is a growing problem with sailing boats colliding with whales at sea, especially at night when the whales cannot be spotted by the watch. I have been corresponding with a multihull designer, Dick Newick, who is requesting assistance from the sound community to come up with a small, simple, acoustic device that would create enough noise beneath the boat to scare whales from the boat's projected path. This device needs to be activated by the water as the boat moves, and preferably could be lowered or suspended into the water without creating a lot of drag. The resulting sound needs to be obnoxious enough to frighten or at least get them out of the path. Smaller is more beautiful when it comes to boats and especially anything that is going to create drag or be in the water. Additional problems are created when deck space is obstructed, so my general feeling is that this acoustic device needs to be very small and either mounted forward, directly to the hull, or be suspended in some fashion from the bow with at least part of it in the water.

One idea which I have forwarded to Dick Newick is that of a vibrating tongue or reed made from shim stock (stainless or bronze -- spring tempered) fastened with screws at one end to the hull(s). This would be at right angles to the flow of water so as to create buzz tones as the sailing boat moves forward. The problems with this device are: there might be sleepless nights for those below attempting to sleep an this device would be semi-permanent as it would be fastened to the hull(s).

I am requesting ideas and/or drawings from the EMI readers to solve this problem. Here's a chance for all you inventors/designers to not only help out that whales but also people, to say nothing of the boats. I told Dick Newick that I would unleash this problem via EMI in hopes that someone with a flash of brilliance might solve this world-wide problem. Perhaps some of the submitted drawings could be published in EMI for feedback (with a copyright symbol between the designer's name & date, should the the creator be worried about losing creative control).

One recent cross Atlantic sailing vessel collided with whales on three different occasions. This is a call for help. Please write me with your ideas and I will pass them on to Dick for his evaluation. Due credit will be given. Thank you for your help!

Richard Waters
1462 Darby Rd.
Sebastopol, CA
95472 USA

ANOTHER NEW ISSUE OF EMI has arrived. In a publication of such consistent quality in content and design as EMI (Robin Goodfellow's illustrations are a really fine addition) it is difficult to say that each issue is better than ever, but I read each new one cover to cover and set it down eager to try it all. There is never enough time but there is always more space and sound than we

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SUBMISSIONS: We welcome submissions of articles relating to new or unusual musical instruments. A query letter or phone call is suggested before sending articles. Include a return envelope with submissions.

"...to the readers, writers and inventors of EMI, so minutely attuned to the sonic landscapes of their

can even begin to explore. In short, EMI is a continual inspiration to pursue the unheard of, in ever new directions.

In light of the exploration of new sound sources, references to Attali's **Noises** (in Charles R. Adams' letter) and your own summary of Godfried-Willem Raes' "My work as an Instrument Maker" in the last issue point to the broader issues relevant to the significance of musical invention. As you point out, Raes' essay moves beautifully from the description of his musical devices to his deeper concerns over "the development of a non-elitist participatory culture." It seems to me that this is what EMI is all about as well. What does it mean that so many inventive people pursue the sort of musical discoveries documented on these pages? Similarly, other publications (e.g. **the improvisor, The Gourd, Glass Music World, Musicworks, Re Records Quarterly, Echology**) describe unusual, out of the ordinary musical interests and preoccupations. It seems to me that we witness an intense disaffection for this elitist, non-participatory, big-money, media-driven, regulated and regimented, mass-produced, use-and-discard, ultimately life-threatening culture of modern life. Vast numbers of people know deep in their hearts that life as it is being promoted is not for them; life is elsewhere. Implicit in the development of a beautiful new instrument lies a desire, if even on one small area of a cluttered workbench, to transform the world, to bring forth a new sound, and, fundamentally, to bring forth the beautiful new being that is singing that sound, issuing that call to our imaginations.

In this regard, I'd like to add two books to Mr. Adams' list of references: **Music-Society-Education** and **Music of the Common Tongue: Survival and Celebration in Afro-American Music**, both by Christopher Small (both published in this country by Riverrun Press, Inc., 175 Fifth Ave., New York, NY 10010). While a discussion of new sound sources is not central to either of these volumes, Small does confront the vast questions of what the musical experience means in human culture and what values are reflected in human **musicking** (Small's new word to replace the cumbersome "music-making" with its inherent commodification of the musical experience). Small's chapters, in their far-ranging implications and remarkable clarity, are about how music can enable us to survive and thrive in the rebirth of a culture that will be life-enhancing in the face of the deteriorating status quo. I recommend these books wholeheartedly to the readers, writers, and inventors of EMI, so minutely attuned to the sonic landscapes of their imaginations that they can hear a new world emerging in the readjustment or removal of a single fret.

Hal Rammel

THE SUPER "SCALE" CHART from the last issue is great. How about something similar with just intonation frequencies or some microtonal & foreign scales, etc.?

Norman Anderson

From the editor: EMI has gotten a lot of good response to the sound spectrum chart that appeared

(continued overleaf)

A NEW EMI CASSETTE IS COMING SOON

This issue is the last of **Experimental Musical Instruments** Volume IV, concluding our fourth year of publication. With the completion of each volume EMI puts out a cassette tape featuring the sounds of instruments that have appeared in the newsletter during the course of the year. The new cassette, **From the Pages of Experimental Musical Instruments** Volume IV, will become available right around the time EMI's next issue does, officially June 1.

It will contain music of instruments featured since June 1988. At the time of this writing the list of pieces to be included has not been finalized -- complete information will appear in the June issue -- but you can be confident that it will remain in the great tradition of beautiful/ugly, serious/silly, familiar/exotic, highly eclectic EMI cassettes. Meanwhile, **From the Pages of Experimental Musical Instruments** Volumes I, II and III remain available at the subscriber price of $6 apiece; $8.50 to others.

NEW RENEWAL NOTICE PROCEDURES

EMI has always been rather civilized in its approach to renewal notices (as compared to mass circulation magazines which send subscribers a stream of increasingly shrill renewal notices starting six months before the subscription is up). Our practice has been to enclose a notice in the last issue of the subscription, followed a month later by a separate reminder if renewal instructions have not yet been received.

Because of a change in bulk mailing procedures, the timing of EMI's renewal notices will change starting with subscriptions expiring after this issue. Henceforth, subscribers will receive a notice about two weeks before their last issue. This will be followed if needed by a reminder six weeks later.

Subscribers can check their expiration date anytime by looking at the number in the lower right corner of their mailing label. The month given there (the first two digits) is the month falling between the last issue of the current subscription and the first of the renewal-to-be.

maginations that thay can hear a new world emerging in the readjustment or removal of a single fret."

in EMI's February issue, and also several comments like this one, relating to the fact that twelve-tone equal temperament was represented while other scale systems were not.

The question of inclusion of 12-equal vs. other systems in the chart was debated around here prior to publishing the chart. Aside from its widespread use and the fact that it forms the basis of the widely-used cents system, the main reason for inclusion of 12-equal and exclusion of others was that 12-equal works well in providing bench-mark frequencies in a chart like this one, built around absolute pitches rather than relative pitch relationships.

Meanwhile, the idea of creating a **relative** pitch chart, comparing pitch relationships in several scales, is an excellent one. Ideally it would show a set of basic just intervals, a couple of important non-western scales, some higher order equal temperaments, perhaps one or two specialized scales designed by representative or influential composers, and, once again, 12-equal as a useful point of reference. Scale charts like this have appeared frequently in **Interval Magazine** and elsewhere, and I have always found them both useful and quite interesting. So keep an eye out; we'll hope to have something along those lines in EMI before too long.

NOTES FROM RECENT CORRESPONDENCE

Included in the last issue's letters section was a letter from Peter Fischer containing a wealth of information on children's instrument making and related topics. In it also was a reference to the use of doped cloth for drumheads in place of plastic or animal hide. "What is doped cloth?" I asked myself. An inquiry to Peter Fischer brought this reply:

I may be using the term "doped" loosely, but I believe that "dope" is a substance used to "size", or fill the pores in cloth, particularly when used as the skin on model airplanes (and, at one time, real airplanes). Doping has the additional effect of shrinking the cloth to which it is applied, which has potential advantages for skinning drums which I have not explored. Having said all that, I believe any common wood finish will suffice, with the exception, perhaps, of lacquer, which is likely to be hard and brittle. Polyurethane or spar varnish is fine. A couple good coats.

A reader with many years of experience as a kindergarten teacher had some thoughts on last issue's discussion of eggshell wind instruments. "I never tried eggs with the children as they were too fragile, but I found coconut shells very durable," she says, adding "but they required a lot of preparation." She used an exacto-knife to remove the meat bit by bit through the holes after drilling them. With the superior glues now widely available, she speculates, it might be easier to saw them in half, clean them and then re-glue them. She goes on to mention that coconut sections can also be used to make tuned water bowls.

Tony Pizzo has sent along miscellaneous information on available resources:

Some interesting modern industrial music appears on Vivenza "metallurgie," from RRRecords, 151 Paige St., Lowell, MA 01852.

A while back there was mention in EMI of a book on Mayan clay whistles. To fill out that reference: The title is **Animated Earth**, by Daniel K. Statnekor, from North Atlantic Books. The book is concerned primarily with these vessels as meditation aids and only secondarily with "harder" information on acoustics, construction and such. A pleasant read.

More on Russolo & friends -- some Italian pressings of Futurist music: **Musica Futurista**, ed. Daniele Lombardi [Cramps 2 record set (1980) 5206-308 & 5206-309]; and **La Voce del Padrone** [EMI Milan (1974) 3C-065-17982]. Also, a related article in **Artforum** (Jan. 1981) by Daniele Lombardi: "Futurism and Musical Notes."

Tony also mentions that he was able to get an excellent conch shell for trumpet making through Benfane Arts (PO Box 298, West Hempstead, NY 11552; (516) 213-483-1330. If you order, ask for "A large pink conch for musical instrument making." $12 purchase price includes shipping.

PHOTO 1: 19-tone equal temperament pipe organ built by Jim Piehl (see the article on the facing page). Also visible on the left in the photo are his early 19-tone guitar (far left) and brake drum guitar.

THE NINETEEN-TONE INSTRUMENTS OF W.A. (JIM) PIEHL AND TILLMAN SCHAFER

by John Chalmers

Jim Piehl and Tillman Schafer were two of the first among contemporary builders to put the 19-tone equal temperament tuning system into practice. Working together and separately in the 1930s and 40s, they made and played several fretted and keyboard instruments designed for nineteen equal. John Chalmers recently had the opportunity to talk to Jim Piehl, and to see his instruments. He has written this report for EMI.

John Chalmers is a microtonal music theorist currently doing research in the Department of Genetics at the University of California, Berkeley, and finishing a monograph on the tetrachord. He founded the journal **Xenharmonikon** in the early 1970s and moved to Houston, Texas, where he has taught biochemistry and worked as a scientist and consultant in the biotechnology industry.

Joseph Yasser's seminal work of the 1930s, **A Theory of Evolving Tonality,** has inspired a number of musicians to escape the confines of the traditional 12-tone scale and explore the resources of the 19-tone equal temperament. Among these were two San Francisco area musicians, Jim Piehl and Tillman Schafer, who worked together in the 1930s and 40s. Their efforts to realize Yasser's ideas resulted in a joint paper which they published in 1947 on their experiments with 19 tone instruments which they constructed. Both men subsequently moved away from Northern California Schafer going to graduate school in San Diego and Piehl to industry in Colorado, but both kept their interest in 19-tone music and continued to construct and play new instruments in this tuning.

Jim Piehl is now retired from his manufacturing business in Denver and has returned to California to reside in Mountain View, bringing with him with the 19-tone instruments he built and played over a period of more than fifty years. He invited me to his home in September 1988 to see the instruments and to suggest people or institutions who might be interested in continuing to play and maintain them. I surmised that Jonathan Glasier and Ivor Darreg of the Interval Foundation and Ervin Wilson and his associates might share Piehl's interest in 19-tone temperament. After querying them, I ham happy to report that they are eager to take charge of the instruments so that they will be preserved and played.

The first new instruments constructed by Piehl were still tuned to the 12-tone equal temperament. In 1932, he built a ten string Hawaiian guitar from a canvas-filled phenolic resin called "Celeron" and an electric guitar whose metal body was originally a Ford brake drum. He performed on these instruments from the 1930s onward around the San Francisco area.

In 1934, Piehl began the construction of a pneumatic 19-tone pipe organ with a generalized keyboard after a design by Schafer. This keyboard has six rows of 30 rectangular black and white digitals and spans five octaves (Figure 1 and Photograph 1). This type of keyboard has the property that the fingering for any scale or chordal pattern is the same in all keys. The white digitals are arranged in lines of six to indicate Yasser's Hexads, while the black keys are placed in groups of three and four to delineate the diatonic scale. Extra digitals are provided to facilitate fingerings in distant keys without having to move the hands great distances across the keyboard. While 19-tone keyboard instruments (cembali) are known from the Renaissance[3] and 19-tone harmoniums from the late 19th and 20th centuries[4], this is the first pipe organ dedicated to 19-tone equal temperament of which I am aware. The instrument was completed about 1939 and is presently dismantled and stored in a crate in Piehl's home. Ervin Wilson, Kraig Grady and Scott Hackleman hope to begin restoring the organ sometime this spring.

In addition to the pipe organ, Piehl refretted a National acoustic guitar to the 19-tone system in 1937. This instrument has had extensive use by both Piehl and Schafer and was later fitted with an electromagnetic pickup. Jonathan Glasier of the Sonic Arts Gallery now has this instrument, which may be the first 19-tone guitar ever constructed.

19-Tone Pipe Organ Keyboard

*C Db	*D Eb	*E	G	A	B	C#	D#	E#	*F Gb	G Ab
C#	D#	E#	*F Gb	*G Ab	*A Bb	C	D	E	F#	G#
C	D	E	F#	G#	A #	B #	C Db	D Eb	F	G
B #	*C Db	*D Eb	F	G	A	B	C#	D#	E#	*F Gb
B	C#	D#	E#	*F Gb	*G Ab	*A Bb	C	D	E	F#
*A Bb	C	D	E	F#	G#	A #	B #	*C Db	*D Eb	E

FIGURE 1

The culmination of Piehl's work is a 19-tone electronic organ which was begun in 1956 and completed in 1961. As with the previous organ, the keyboard is generalized, albeit with a slightly different pattern. It has 91 digitals covering

five octaves (figure 2 and photograph 2). Three colors are used on the keys; white for the seven diatonic notes, black for the seven accidentals, and grey for the five extra notes, V, W. X, Y, and Z, of Yasser's nomenclature[5], though Piehl preferred to use a dot over the note name. The organ utilizes Conn sound-generating components and has ten timbral stops with tremolo, division and swell effects. In addition, a pedalboard provides eight and sixteen foot bass tones. When I visited Piehl, he played the organ for me, and I can attest that the instrument has a much better tone quality than most other electronic organs and that the keyboard is surprisingly easy to learn and play.

Although Piehl has seldom played the electronic organ in recent years, he used to enjoy performing tonal pieces originally composed in 12-tone equal temperament in the 19-tone tuning where they acquire the particular mood of the system. Piehl feels very strongly that 19-tone temperament should be the next tuning adopted for Western music and that the transition will be made easier by first accustoming audiences to the sound of the traditional repertory in 19-tone tuning before pieces composed specifically for this system are presented.

19-tone Electronic Organ Keyboard

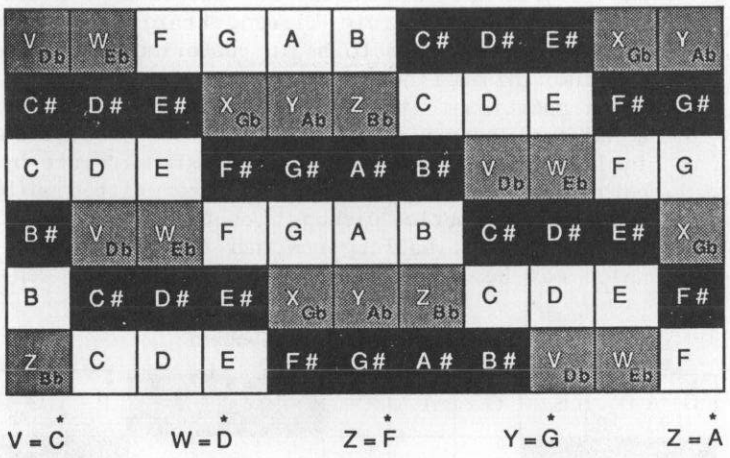


FIGURE 2

Unfortunately, years of corrosion have caused some of the contacts in the keyboard to fail, so at the moment not every note sounds in all the stops. Restoration will be comparatively easy, however, and well worth the effort to save this unique instrument. Darreg and Glasier intend to begin restoration this winter at the Sonic Arts Annex.

After spending a number of years as a physicist at the Naval Electronics Laboratory in San Diego, Tillman Schafer moved to the East Coast in the late 1960s and now lives in Massachusetts where he plays traditional guitar professionally with his wife.

Schafer also refretted a guitar to 19-tone

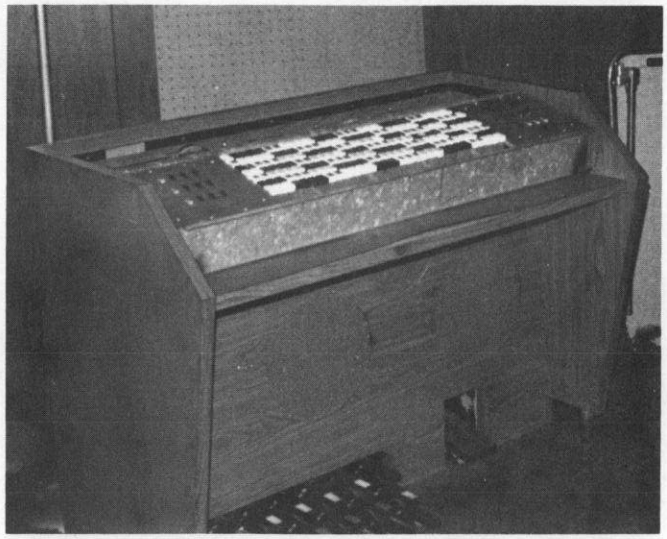
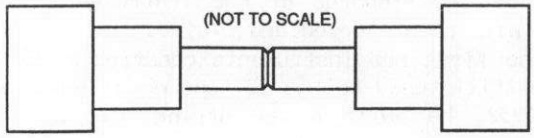


PHOTO 2: Jim Piehl's 19-tone electric organ.

equal temperament and moreover converted one at a later date to the 31-tone system, the next evolutionary stage in Yasser's scheme. In 1941, Schafer wrote a thesis on Yasser's theories and their embodiment on electronic instruments. Several years later in 1946 after discussions with a tuned percussion expert, he constructed an electrically-actuated 19-tone metallophone to demonstrate these concepts. This unique instrument had three octaves of metal bars of cylindrical cross-section furnished with electro-magnetic pickups. It was played from a keyboard derived from an electric typewriter. Pressing a key caused a solenoid to propel a striker towards the corresponding bar. A noteworthy feature of the design was the shapes of the bars, which were calculated to correct the first two overtones to the octave and the double octave (Figure 3). The central indentations were used for fine tuning. The shapes of the bars and the placement of the strikers also served to minimize the contribution of approximations of the third and sixth harmonics to the timbre because, in Yasser's Hexad-based harmony, the fifth, the minor third, and their inversions must be treated as dissonances.

I viewed this instrument at Schafer's home in San Diego during the 1960s. Although the electrical components had deteriorated, the array of tuned bars was still in tune and playable. They were remounted by Ivor Darreg and are now with

FIGURE 3 SHAPE OF BARS ON SCHAFER'S 19-TONE METALLOPHONE



Buzz Kimball in New Hampshire.

Schafer has now donated his 19 and 31-tone guitars to Jon and Bradford Catler who are known on the East Coast and especially in New York City for their band, "The Microtones," which has appeared in Johnny Reinhard's "American Festival of Microtonal Music" concert Series.

It is indeed fortunate that the network of people interested in playing and constructing new instruments has grown to the point that unique creations such as those of Piehl and Schafer can be preserved, not just as museum pieces, but as working instruments upon which musicians can perform and for which composers can write.

1. Yasser, Joseph. 1932. **A Theory of Evolving Tonality.** American Library of Musicology, New York, NY, USA.

2. Schafer, Tillman and W.A. Piehl. 1947. "Musical Instruments in Nineteen-Tone Equal Temperament". **Journal of the Acoustical Society of America** Vol. 19 #4: 730.

3. Barbour, James Murray. 1951. **Tuning and Temperament.** Michigan State College Press, East Lansing, MI USA. Second edition 1953, reprinted 1961.

4. Mandelbaum, M. Joel. 1961. **Multiple Division of the Octave and Tonal Resources of 19-Tone Temperament.** Unpublished dissertation, Indiana University, Bloomington, IN USA.

5. Yasser labeled the 19 tones of the octave C, C#/Vb, V, D, D#/Wb, W, E, E#/Fb, F, F#/Xb, X, G, G#/Yb, Y, A, A#/Zb, Z, B, B#/Cb, c, where # or b indicates an inflection of 1/19th octave (Yasser's own # and b symbols were slightly different). The standard nomenclature may also be used for 19 with the sharps lower in pitch by one degree than the flats, i.e. C C# Db D ... etc.

6. Schafer, Tillman. 1941. **The Music of Tomorrow: The Supra-Diatonic Scale, A new Concept of Timbre, The Electronic Musical Instrument.** Unpublished thesis, Reed College, Portland OR, USA.

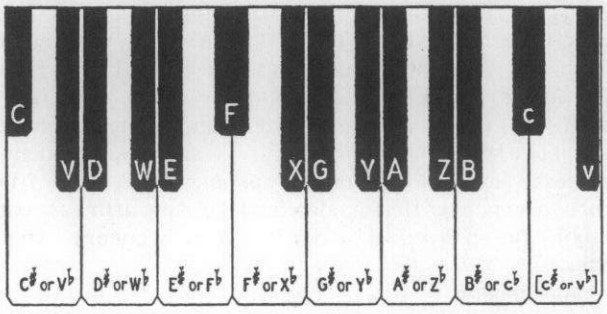
WHO'S GOT WHAT AND WHAT'S WHERE

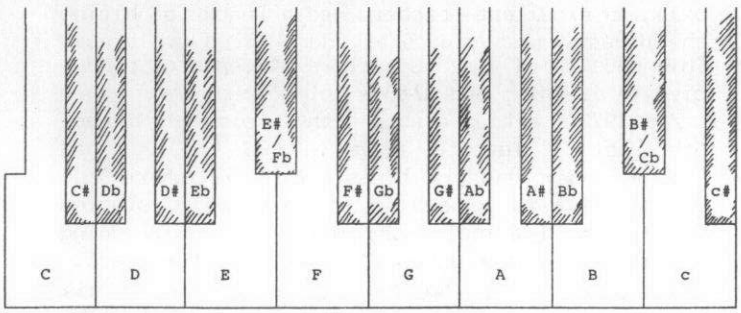
As mentioned, many of the instruments described in this article are now held by the Jonathan Glasier and the Interval Foundation, which can be reached through Sonic Arts Gallery, 612 F St., San Diego, CA 92101; (619) 299-7809. The original tone bars for the 19-tone metallophone are now being kept by Buzz Kimball in Contoocook, New Hampshire. Ervin Wilson, who, it is hoped, will be restoring the 19-tone pipe organ, may be reached at 844 North Ave., 65, Los Angeles, CA 90042. Jim Piehl and Tillman Schafer are not available for direct inquiries; for further information on the instruments contact the Interval Foundation or this article's author, John Chalmers, at his California address: 6881 Sherwick Dr., Berkeley, CA 94705.

WHAT IS 19-TONE EQUAL TEMPERAMENT?

For people interested in pursuing scale systems outside of the 12-tone equal temperament tuning that has become standard in Western music, one set of possibilities is higher order equal temperaments. These are systems that, like twelve equal, divide the octave into equal intervals, but which have more than twelve steps per octave. A few higher order equal temperaments have stood out as likely candidates for wider use and popularization. Nineteen tone equal temperament is one of these, primarily because it happens to do a fairly good job of approximating the most important intervals of just intonation, without requiring an inordinately large number of pitches per octave to do so. Nineteen-equal also possesses the advantage that it has some convenient relationships to twelve-equal, both in terms of the ways we name pitches and organize them conceptually, and in terms of possible keyboard layouts. These correspondences have the potential to make the transition from the familiar twelve to the unfamiliar nineteen easier than would otherwise be the case.

BELOW LEFT AND RIGHT: One promising keyboard layout for 19-tone equal temperament. At left is a diagram reproduced from Yasser's **Theory of Evolving Tonality,** showing the peculiar pitch naming system refered to in this article. At right is the same physical layout, but marked with the pitch names favored by many current 19-tonalists. The conceptual and physical similarity of this design to the standard 12-equal keyboard eases the transition from the old to the new. The note-naming system shown at right likewise dovetails very nicely with the current standard approach. Notice, however, that this keyboard, like the current standard but unlike Schafer and Piehl's, is not generalized, meaning that transposition is not possible without altering fingering patterns.





SHAPE AND FORM, CONTEMPORARY STRINGS

Part II: William Eaton, Steve Klein & Linda Manzer

Notes by Bart Hopkin and
the builders whose work appears.

This is the second half of a mostly-photographic presentation of instruments by several unusually creative builders of plucked and bowed string instruments. Part I, featuring instruments built by Fred Carlson, Francis Kosheleff, Susan Norris and Clif Wayland, appeared in EMI's last issue (Volume IV #5, Feb. 1989).

This time around we present the work of three guitar makers who have developed an expanded sense of possibilities. The instruments shown here do not differ dramatically from familiar string instruments in their basic methods of sound production. They do depart from from the familiar in overall shape and form. Carving, inlay and other decorative features in these instruments likewise break from traditional constraints.

Here, then, are several more pages of beautiful, one-of-a-kind sound shapes.

LINDA MANZER is a guitar maker living in Toronto. She has provided these notes on her work:

I became interested in making musical instruments in 1969 when I searched for a dulcimer and found a "kit" for half the price of an already built one. The sheer pleasure I felt in listening to an instrument that I had assembled with my own hands is still a vivid memory. The bug had bit, and little did I know that, wiggle as I might, all paths in my future would lead right back to instrument making.

In 1974 I began an apprenticeship with Canadian guitar maker Jean-Claude Larrivee. I stayed with Larrivee for the next 3½ years. I once calculated during the years I was there we made 1500 steel string and classical guitars. Jean, as well as being an excellent teacher, had a knack for hiring the nicest, most dedicated and skilled employees. This made for a very supportive atmosphere, conducive to learning and also a lot of fun.

In 1978 I set up a shop with lute maker Michael Schriener in Toronto above a pool hall. I had little money and no tools. This is where the school of hard knocks kicked in and I started struggling. I skipped many meals and recall doing nothing but guitar making for the next few years.

In 1982 I met Pat Metheny after one of his concerts here in Toronto, and he ordered a 6-string guitar. Over the next five years he ordered a series of diverse and exotic instruments from me. With a few exceptions, I had never before built, or in some cases even envisioned, these instruments, so I was required to research or design them myself. Pat would tell me what he wanted and I would do my best.

The Pikasso Guitar began when Pat Metheny asked me, with a smile, how many strings could I put on a guitar? Our resulting collaboration yielded the instrument shown here. It has 42 strings in three groups of 12 strings and one rather normal neck with 6 strings. The 6-string has a hexaphonic pickup to trigger his Synclavier as well as a Fishman piezo under its saddle. The other three sets of strings also have piezo pickups. The second neck sounds somewhat like a koto (usually tuned chromatically); the third neck sounds slightly like an autoharp due to its duplication of strings; the fourth neck has an extremely wide range and is used primarily for accent or color. There are also two brass fittings inside the body so it can be mounted on a stand thereby leaving the hands free when performing. There are two access doors so that adjustments can be made to the interior electronics without loosening any strings. Each of the pickups runs through a custom-designed preamp en route to the master onboard control panel (designed by Mark Herbert, Boston, MA (617) 522-6524). This instrument can be heard on the album SONG X by Pat Metheny in the song "Mob Job."

As I worked on this series of instruments over the course of a few years, word was circulating that I made "unusual instruments." I received a call from Bruce Cockburn asking me to help him out with a problem. He was going on a world tour in a few months. He had a charango from Nicaragua that he loved, but it was very delicate and he feared it would not stand up to the rigors of the road. Together we came up with the idea to build an electric semi-solid body charango with a custom-made Fishman pickup. It had hollow chambers inside to keep the warmth of an acoustic instrument, but it was stable because it was largely solid and it was not made from an armadillo shell. I colored it blue to match his other instruments -- why not, eh?

In 1988 I was commissioned to build a 20-stringed instrument for Angel Parra. He had had such an instrument built in Chile by a carpenter and it was in pretty rough shape. He told me that this was a Chilean instrument, but I have been unable to find any information about one anywhere I suspect that the instrument I used as a reference was one of a kind. I presented it to him before a concert in Toronto and to my surprise and delight he played it during his concert that night.

Most recently I was commissioned to build an arch-top 6 string bass guitar. It had an 86 cm scale length with German spruce top and curly maple back and sides, with a solid core down

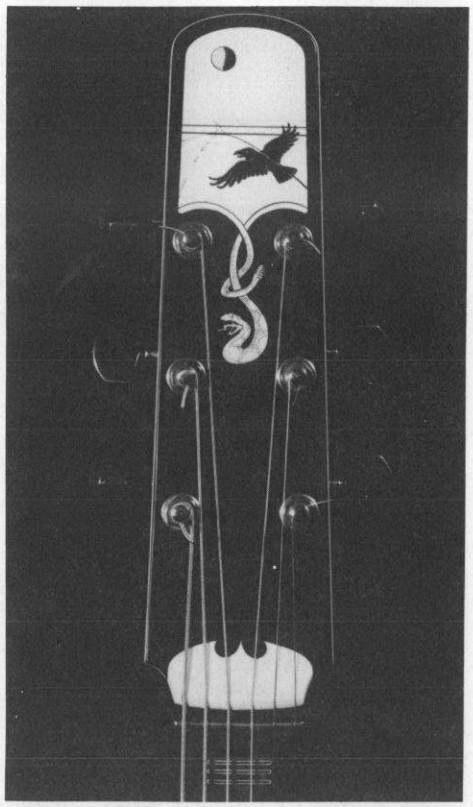
THE PIKASSO GUITAR, described in the accompanying notes.

the center of the body. This had a twofold purpose: First to stabilize the top from the tremendous down pressure of the strings, and secondly to prevent feedback problems, as the instruments was to be amplified in a concert situation. The result was an acoustic bass sound in a smaller more manageable size.

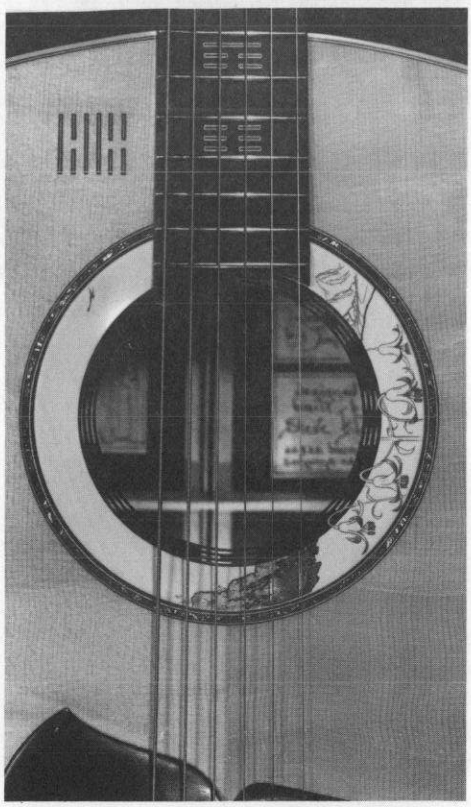
I find it impossible to begin working on an instrument until I have a clear picture in my mind of what I want. Otherwise it's like driving in downtown Boston without a roadmap. You don't get where you are going and you use up a lot of gas, But hey, maybe you get to see a lot more of Boston that way! I guess it's all how you look at it.

For more information on instruments by Linda Manzer, contact her at Manzer Guitars, PO Box 924, Stn P, Toronto, Ontario, Canada, M5S 2Z2; (416) 927-1539.

Below: EIGHT-STRING DRONE GUITAR, made by Linda Manzer for Pat Metheny, with a sitar-style buzzing bridge. The individual bone saddles under each string can be adjusted to create different qualities of buzz.



Above & below: ROSETTE AND PEGHEAD INLAY. These are detail shots from a guitar designed and built by Steve Klein for Joni Mitchell.



..... Steve Klein .....

STEVE KLEIN is a Northern California builder who works primarily, but not exclusively, with guitars. His instruments are built "from the inside out" (Steve's words), meaning that the natural flowing forms are not fanciful or whimsical, but arise from practical considerations relating to acoustic design, structure and playability. Much of the thinking behind the instruments is based in the work of Michael Kasha, a physical chemist and prominent (to some, controversial) researcher in guitar acoustics. One striking Kasha design element appearing on the Klein guitars is the asymmetric bridge. The internal soundboard bracing patterns, also highly unconventional in their arrangement, are designed to work with the bridge.

Many of Steve's earlier instruments were highly decorated with finely crafted inlay work. More recently he has tended more to let the logic, simplicity and elegance of the basic instrument design speak for itself, adding accordingly less decorative work.

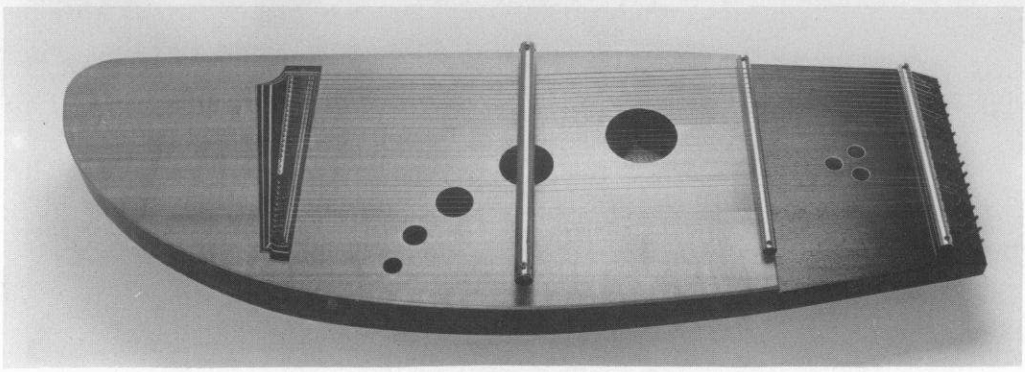
Steve Klein has been building custom instruments since 1968. He has recently created the Klein electric guitar, ergonomically designed for a good playing angle in sitting positions. For more information, contact Steve at Klein Custom Guitars, 2560 Knob Hill, Sonoma, CA 95476; (707) 938-4189.

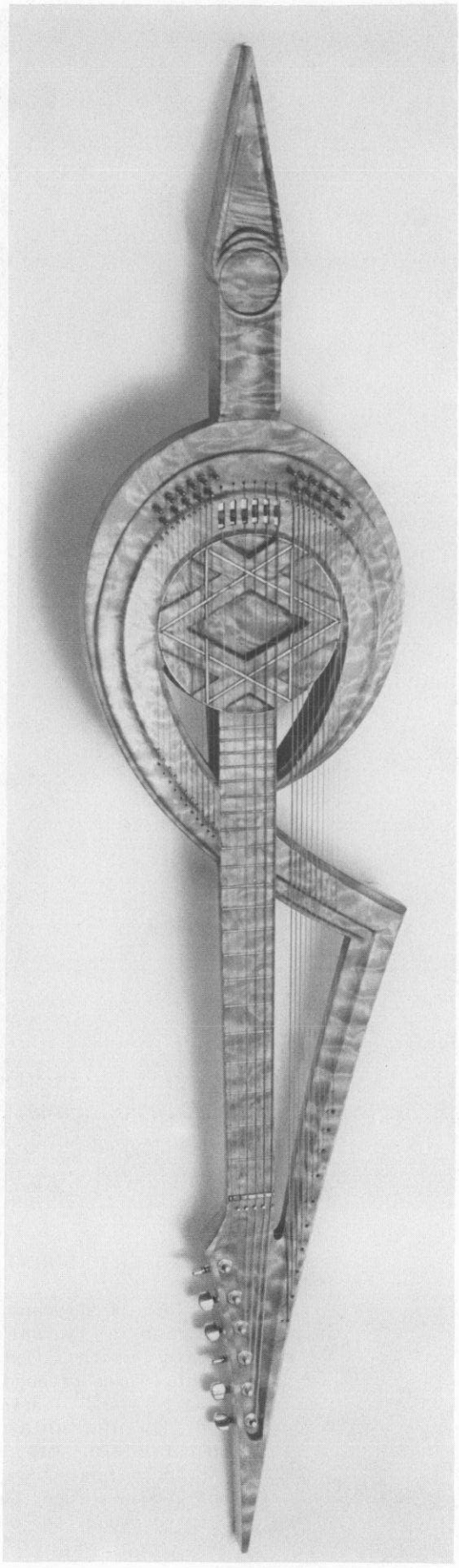
Above: STEEL STRING GUITAR

This instrument exemplifies a typical Klein design, with round lower bout, foreshortened upper bout, and asymmetric bridge. The inlay is a partial star map of the Northern hemisphere. Made of German spruce, Guatamalan rosewood, and ebony.

Below: SHAKTI HARP

This twenty-eight-string zither was designed and built for performing musician Bruce BecVar, to Bruce's specifications. It can be heard on his LP, "The Nature of Things." The stainless steel bar across the middle divides each string into two equal parts, allowing for sympathetic vibration on the opposite side of the bar for each plucked note. The additional open string length on the far right allows for koto-style string bending. Made of Sitka spruce and bubinga.



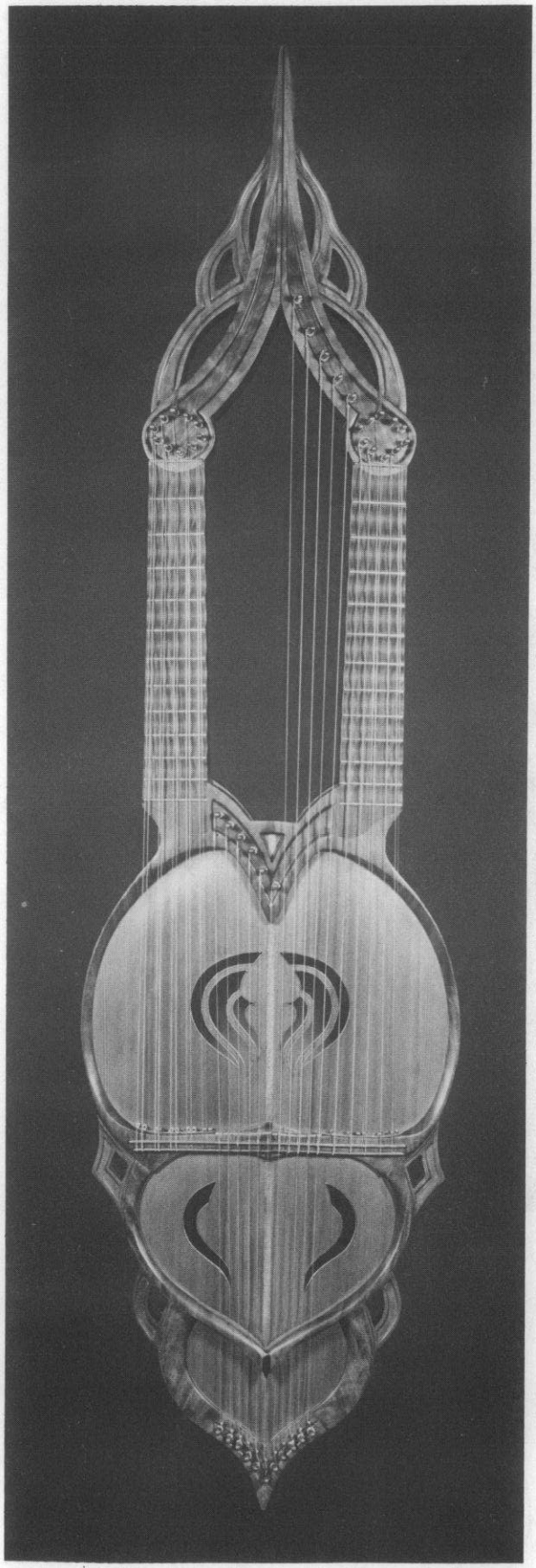


WILLIAM EATON lives and works in Tempe, Arizona, where he is a part time instructor and administrator at the Roberto-Venn School of Lutherie. He is a composer and performer as much as he is a builder, and, after years of composing for plucked strings, has recently written and had performed several pieces for chamber orchestra. He does not build in quantity, but builds primarily to fulfill his own musical ideas and performance needs. The instrument designs often reflect an affinity with ancient instruments and mythological motifs, as well as forms and shapes of the natural world.

Recordings of William Eaton's compositions and instruments can be heard on the LP **Music by William Eaton** (available from the artist, address below) and the newly-released cassette **Carry the Gift**, recorded with R. Carlos Nakai on Native American flutes, available from Canyon Records (4143 N. 16th St., Phoenix, AZ 85016). For further information contact William Eaton at PO Box 670, Tempe, AZ 85280; telephone c/o Roberto-Venn School, (602) 243-1179.

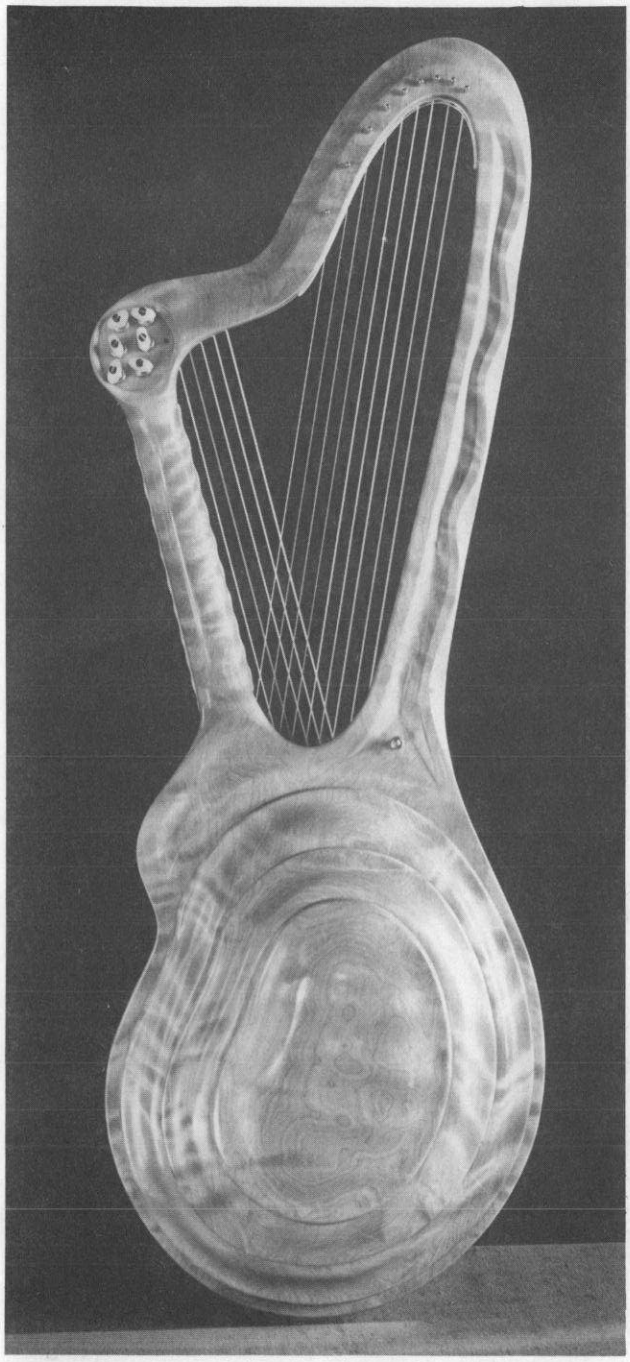
At left: SPIRAL CLEF

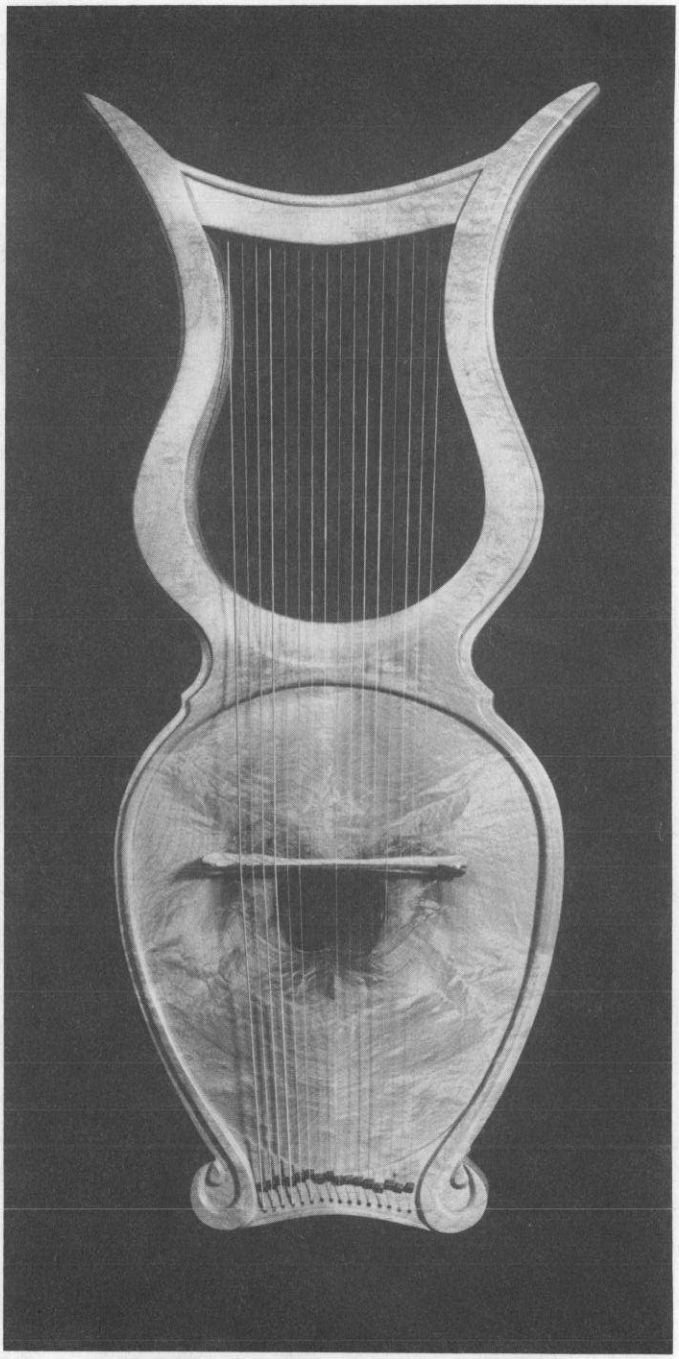
Below: HARP GUITAR, in the hands of the maker.



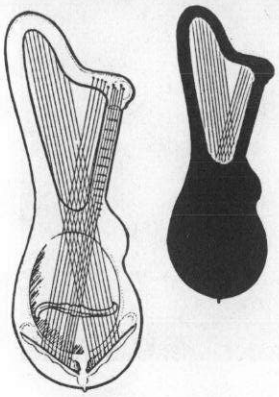
O'ELE'N STRINGS

26 STRING GUITAR





20 STRING HARP GUITAR. This is the instrument that decorates this issue's cover; shown here from behind.



10 STRING LYRE

SOUNDS IN CLAY

by Ward Hartenstein

Ward Hartenstein is a sound artist living in Rochester, New York. His education has been in ceramics and fine arts, and he has combined this with a life-long interest in music to develop an array of unusual ceramic instruments and sound sculptures. In addition to marketing and exhibiting his work at galleries and art festivals, he composes and performs with his instruments and visits schools and museums to conduct workshops and concert events.

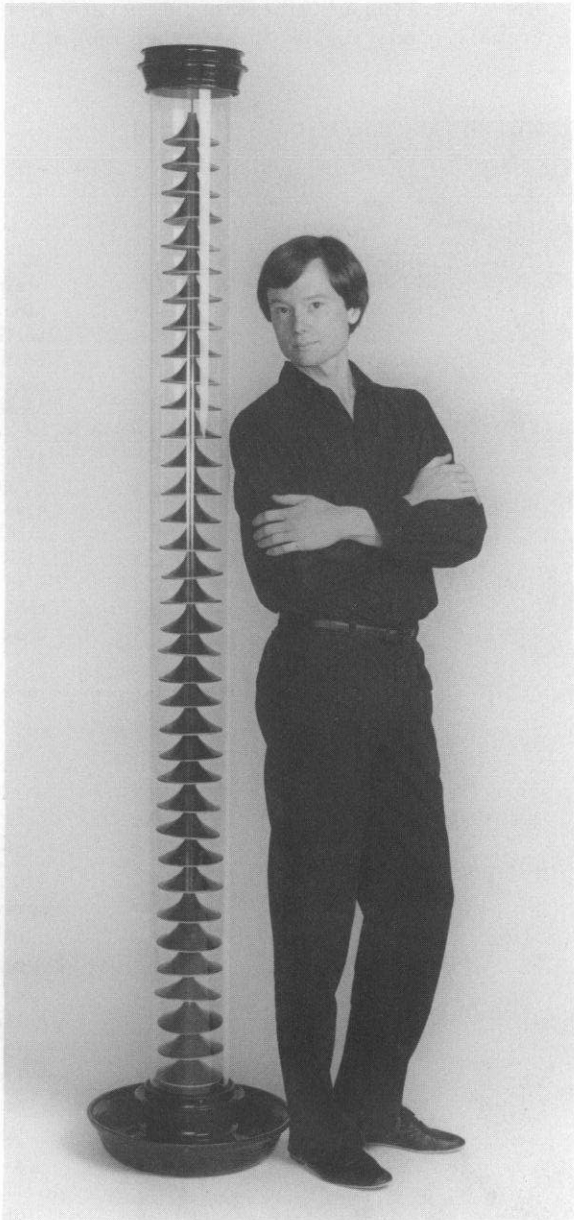
(continued from page 1)

but the concept of ceramic idiophones is one for which few historic precedents exist, and resource information available on other acoustic materials (primarily wood and metal) is only partially applicable.

The physical limitations of clay as an acoustic material are at first rather imposing -- its low tensile strength makes it subject to structural failure if it absorbs too much kinetic energy (if you hit it too hard it breaks) and its rigid crystalline structure makes it difficult to apply common fabrication techniques for both additive and subtractive construction (it is literally as hard as rock). The other serious drawback to the material is that in its plastic state it produces no sound, so that while the shaping of the raw clay into acoustical forms is relatively easy, there is no way to measure, sample, or qualitatively analyze the vibration of a clay structure in any way until after it is fired, at which time it is too late to do much about altering its basic form.

But it isn't as impossible a situation as it seems, because despite the sometimes discouraging aspects of the trial and error method, there **are** some formats that we know work, and a bit of applied physics can make them work even better. A bowl, for instance, is a natural sound producer, and a brief experiment with bowls of varying shape, size, and material will reveal an underlying pattern of sound quality and pitch as related to thickness, diameter, density, mass distribution, etc. Clay, of course, is a common material for the making of bowls, and almost any bowl, funnel, or bell shape made of a dense high-fired clay will produce a musical sound when struck near its edge. I have made many different kinds of instruments using clay bowls in suspended or resting arrangements, coupled with resonating chambers (the bowl itself can even act as a resonator), and grouped in graduated sizes to produce a range of pitches. These "sound bowls" function in the manner of one of the most ancient percussion instruments, the bell.

Some general tips on making clay bells are as follows: maintain a relatively thick edge for strength and pitch definition; support structures should contact at nodal points (center is always good) or along nodal lines; radial symmetry is not absolutely required, but asymmetric bells may have some strange tonal quirks (multiple pitches or dead spots); slits, holes and edge cuts can drastically alter the vibrational pattern, and may



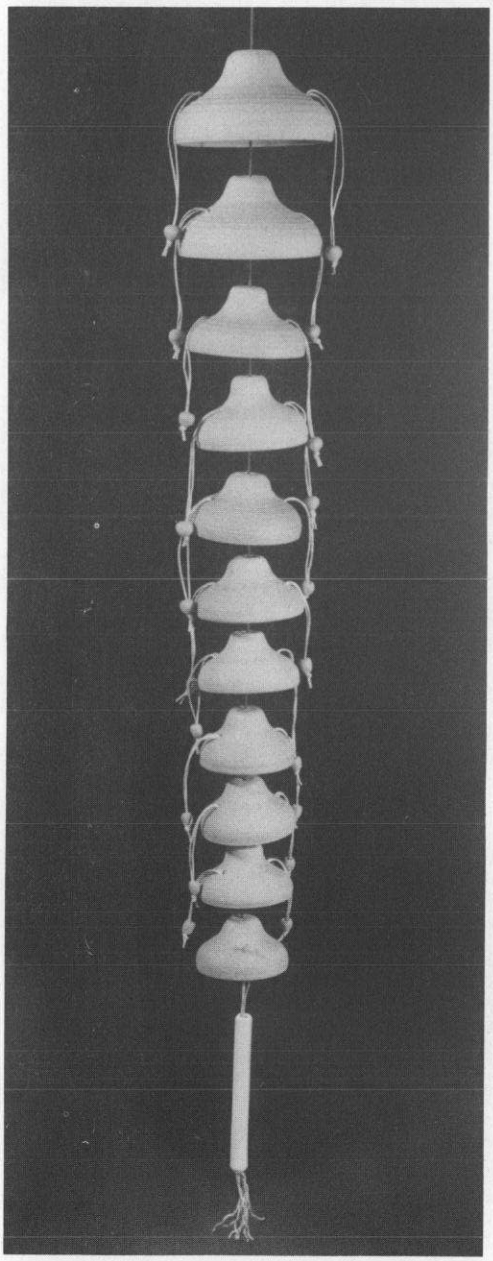
Ward Hartenstein with his FOUNTAIN CHIME. Steel pellets are dropped through a clear acrylic tube, cascading over a column of clay chimes and emerging through a trough in the base.

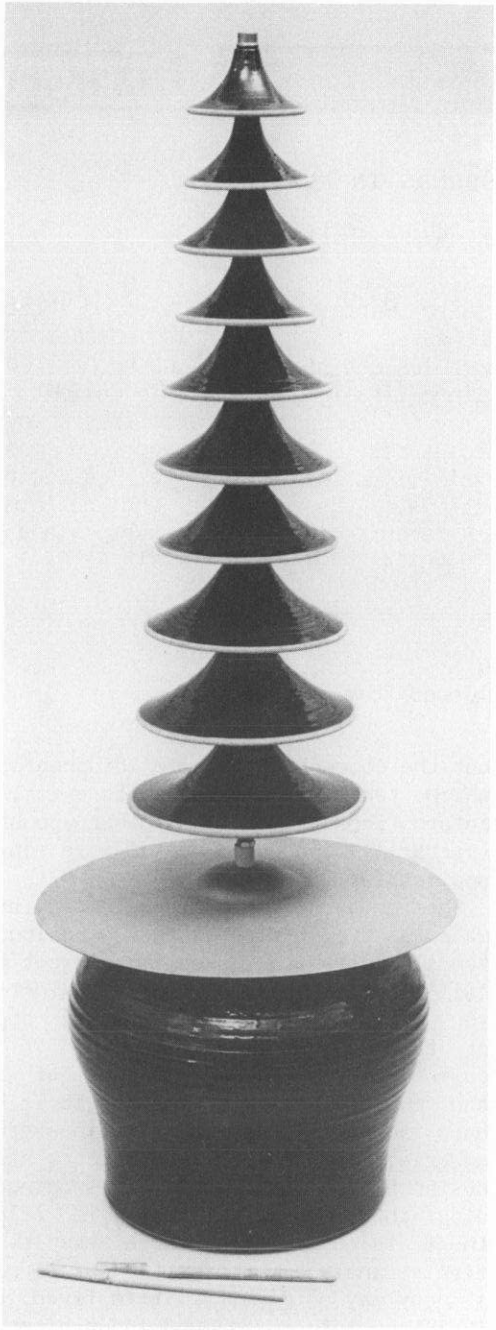
produce some unusual results.

Things get rather tricky when it comes to the tuning of clay bells. Most bells, whether made of clay, metal, glass, or any other dense material, have a very complicated harmonic structure, and much research has been done on the overtone tuning of carillon bells in particular. Clay bells, however, generally have a strong fundamental pitch which can be measured (I use a quartz tuner), so that out of a group of various sized bells, a few can be selected which have discernible pitch relationships. My approach is to make dozens of bells ranging in size from 3" to 8" in diameter and then pick and choose from them a grouping with interesting tonal relationships. The only practical approach I have discovered for altering the pitch of a given bell is to grind away at the clay wall with a diamond lapidary wheel. This may lower the fundamental slightly (as well as changing all the overtone relationships) but it also leaves an unsightly scar. It is of course possible to tune resting bells with the addition of water, and this is a common practice not only with musical water glasses but also with the traditional Indian instrument called a jaltarang.

The other type of vibrating structure with which I have had extremely good results in my experimentation with clay is the "free-end bar". Instruments of the marimba family date back to prehisoric times and have been used by many cultures and constructed from many diverse materials: rosewood, bamboo, redwood, bronze, aluminum, steel, man-made materials, and even stone and glass. Noticeably absent from this historic list of bar materials, whether because it has not survived the rigors of time and weathering or because it has never been tried, is that wondrous product of earth and water: clay. I developed my first Clay Marimba in 1980, and since that time it has become the mainstay of my "Sounds in Clay" repertoire, evolving into an instrument with great musical potential both as a basic sound source and as a solo or ensemble performing instrument. Its sound is clear and bell-like and distinctly different from the orchestral marimbas, xylophones, glocken-spiels, and vibraphones with which we are familiar. I like to describe its tone as both delicate and earthy, a seeming contradiction in terms which reflects the dual nature of the material itself as well as reminding us of its source.

The physics of the free-end bar are relatively straightforward. As with bells, the factors of size, density and mass





At left: Ward Hartenstein's SHAKER CHIME, a hanging column of clay bells which can be wind or hand activated with a gentle shaking motion. Approx. 6" x 6" x 45".

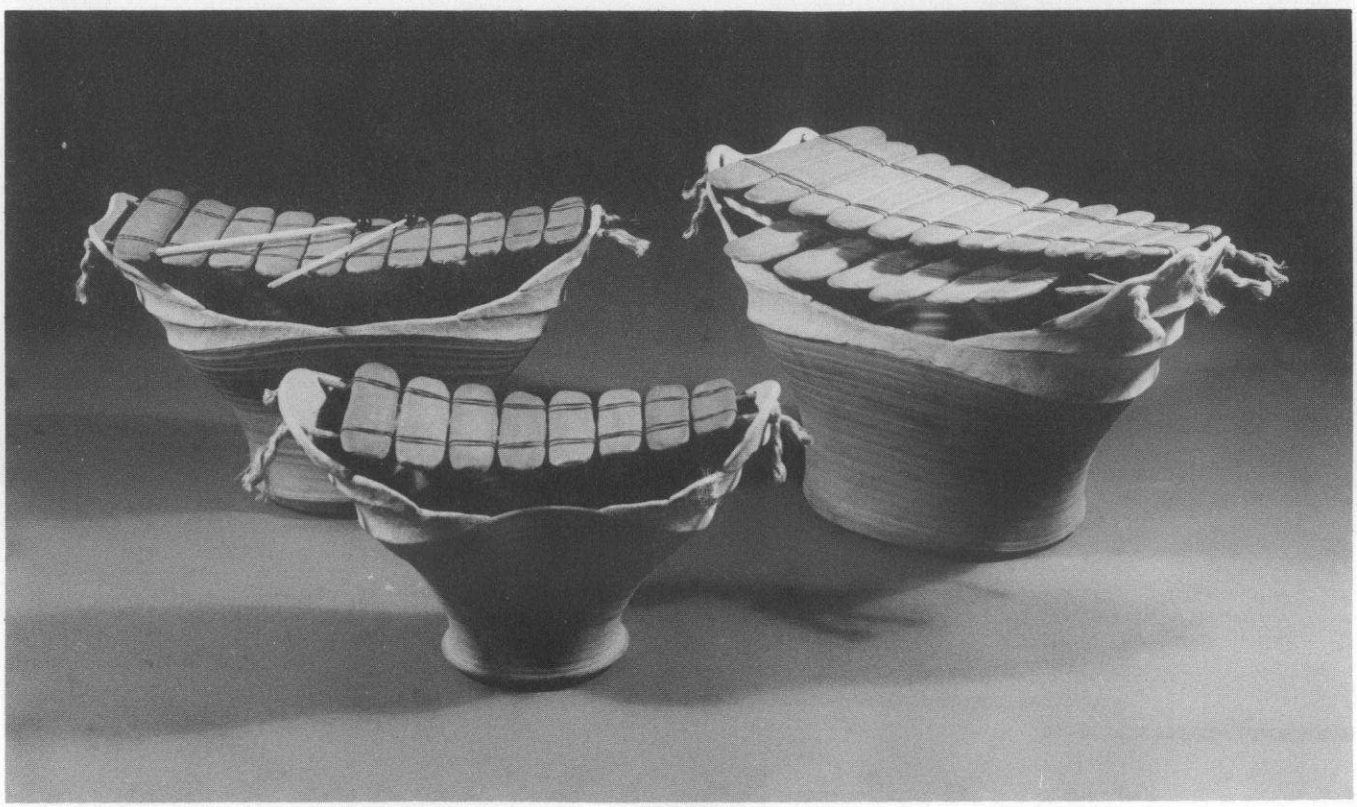
At right: CYM-BELL TREE, a column of graduated clay bells mounted on a steel rod attached to a clay base (also a bell) with a metal cymbal fitted over a resonating chamber. 14" dia. x 40"h.

distribution have a direct and proportional relationship to fundamental and overtone pitches. Additionally, the composition of the bars, their method of support and the means of setting them into vibration, as well as their proximity to resonating structures, will affect the overall sound quality. In general, any oblong slab of hard dense material can be made to vibrate with a resulting sound; what makes it a "musical" sound is the degree of control exerted on the vibrational system. An examination of any of the traditional marimba-type instruments will show that the bars are graduated not only in length, but often in thickness and width as well. They are also thinner in the middle than at the ends, which allows for a more harmonic overtone relationship and provides greater flexibility within the bar itself. They are supported loosely at the nodal points for the fundamental frequency which are about one fifth of the total length from each end (this varies with the mass distribution -- for a bar of rectangular cross section with uniform thickness, width, and density throughout its length, the nodal points for f1 [the fundamental frequency] will be found at points .22 of the length from each end. As the middle is thinned out, the nodal points move closer to the ends and the interval between f1 and f2 [the first overtone above the fundamental] increases). Lastly, it can be observed that the bars are often situated over individual tubular air columns or one or more large open resonating cavities which amplify the sound waves from each bar (at the cost of shortening their overall vibration time).

With practice, I have been able to shape clay slabs by hand whose mass distribution produces a first overtone about an octave and a half above the fundamental. This corresponds to the tuning of a xylophone; an orchestral marimba is tuned to a two octave spread between fundamental and the first overtone, but the thinness required at the midpoint of the bar makes this impractical for clay bars. As with clay bells, I find that I need to make many bars, often a hundred or more, from which to choose a set that matches up in size, appearance, and approximate pitch relationship. Fine tuning is accomplished again with a lapidary grinder and is a long, painstaking process of removing material and measuring frequencies. In general, material removed near the midpoint will lower the pitch, and material removed near the ends raises the pitch. Both of these operations may alter the overtone relationships along with the frequency values. Particularly with the larger bars, which require accurate overtone tuning so as not to sound "clanky", the process of grinding becomes rather like acoustical acupuncture, as material is removed at various combinations of points along the underside of the bar to arrive at the right balance of frequencies. To raise the first overtone while keeping the fundamental approximately the same I grind at the ends and a little bit in the middle; to lower the first overtone and keep the fundamental I grind a wide area around both fundamental nodes.

It is possible to set up virtually any type of scale; I have made clay bars ranging in size from 24" down to 4" corresponding approximately to a four octave span from F3 to F7 (C4 designates middle C). The larger the bar, the greater the need for a resonating cavity to reinforce the fundamental. This can be a tuned tubular resona-

CLAY MARIMBAS by Ward Hartenstein. An adaption of the traditional instrument utilizing carefully tuned stoneware bars mounted over a resonating chamber. Produces bright ringing tones when struck with hard wooden mallets.



tor or, as I prefer, a large cavernous chamber which may lend some distinct colorations to the sound of a particular set of tuned bars. I find that the clay bars stay in tune reasonably well, with a variance of less than 10 cents over a period of several years. Exposure to moisture is the main cause of this and is an indication of the inevitable process of rehydration which will eventually (over the centuries) break the crystalline structure back down into raw clay particles. In an extreme result of weathering, a clay bell may begin to lose some of its ability to maintain a vibration (and start to sound "thunky") after a few years exposure to the elements, particularly the freezing and thawing of northern climates which allows microscopic fissures to develop within the structure of the clay molecules. But potters throughout the ages have always taken the fragility of their wares as an assurance of the continual demand for new clay objects.

I encourage others to experiment with clay as an acoustic medium. Many kinds of traditional wood or metal instruments can be adapted for manufacture using clay. The process of the craft may suggest new approaches to sound forms -- woodworkers tend to make boxlike forms, metal workers build forms out of rods, tubes, and flat sheets, clay workers tend to make round, bulbous forms. My feeling is that whatever the medium, an instrument should be a thing of beauty, both visually and aurally, and often the best designs on both counts result from an inspired solution to a technical requirement of the sound making process. Examples of this can be seen in the classic reverse curve of the violin family which allows for free movement of the bow, or the graceful twisting and spiraling of many of the early brass horns designed to compact the greatest length of tubing into the smallest space.

Music is truly a multi-sensory experience. It is influenced by our awareness of sounds and sound sources both in nature and in our man made world of art and technology. As listeners we are as much affected by the perceived **act** of sound making as by the physical transmission of vibrational energy to our ears. It is for this reason that we as instrument makers seek not only new sounds (for if that were the point we might deal only with digital and electronic sound information) but also new mechanical and acoustical systems, new materials and processes, and new experiences of sonic creation.

The author welcomes letters of inquiry, feedback on technical or aesthetic issues, and particularly word of anyone (past or present) working with clay as an acoustic medium. Write to:

Sounds in Clay
282 Meigs Street
Rochester, NY 14607.

INSTRUMENTS

THE SINK: A Found-Object Idiophone

by Rick Sanford

With regard to found object musical instruments, my credo has always followed an African proverb: "One fresh fish, one rotten fish; two rotten fish." Some instrument collectors disagree: junk auto hubcaps, pie plates and refrigerator doors are continually added to collections of exotic temple bells, berimbaus, African sanzas, etc. Such juxtapositions achieve only volumes of sounds rather than any sound quality, and my feeling is that a good 50% of the average found-object instrument collection should be returned to its source: the garbage.

With one exception. Scrap piles remain a good source of stainless steel, upon which percussion sounds are most engaging: subtle in harmonics and sustain, shattering in resiliency and loudness. I can't think of a conventional musical instrument made of stainless steel, so it's natural for it to appear in the found object realm.

My own exception of this type is a piece dubbed "the sink;" a large, cube shaped piece of stainless steel which is suspended in a metal frame and actuated by all manner of stick, soft mallet, gong mallet, super-ball, bow, sheet-metal screw (tapped holes are provided), etc.

The sink was originally obtained as one of twenty-six instruments for a percussion ensemble ("Variations" 1985) I wrote. It provided a link between the lowest-fundamental tam-tams (12-20 Hz) and the even lower thunder sheet, which was eight feet tall and allowed for manual control (oscillation by hand) of its pitch. The sink became useful for more musical situations and, being free of corrosion and a rather pure shape, has also served as an item of furniture. Not that its musical life is over; in fact, I've played it much more this last year.

I figure the sink is a remnant of a restaurant or hospital fixture. It is called the sink since it is square, roughly waist high, and has a hole in one side, perhaps for a plumbing or electrical connection. It's roughly 25 inches wide, 30 inches high and 30 inches deep. There's no top or bottom, so it's like a four sided box.

It's pieced together with welds at the rear, with various tabs and flanges in what appear to be mounting arrangements. The bottom edge has an inch or so all around turned in at a right angle to the sides. This gives the bottom great rigidity, like the edge of a gong. The front is a couple inches shorter than the rear, and has an outwardly-turned flange which is great for playing on with sticks. The rear has a similar flange, but turned in like the bottom. Both these flanges

(continued on facing page below)

Books

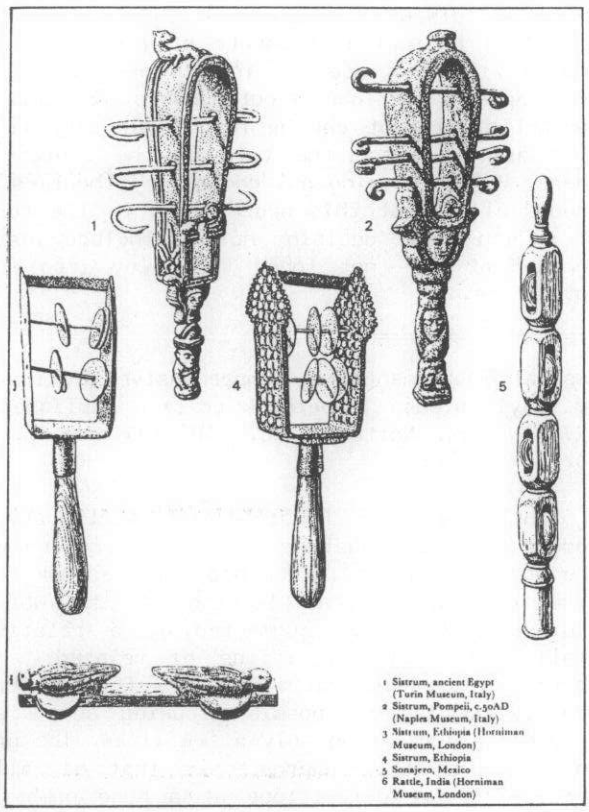
THREE ENCYCLOPEDIC SOURCES

Reviewed by Bart Hopkin

In this issue's books column we look at three works designed to present the world of musical instruments in a comprehensive fashion. The importance of the three lies in the facts that they are more or less up to date, are currently in print, are global in scope and reasonably free of cultural bias, and are presented in formats designed for ready location of specific information. In other words, they are practical desktop reference works, and serve a purpose that other books on musical instruments do not.

Musical Instruments of the World: An Illustrated Encyclopedia, by the Diagram Group (published in 1976 by Facts on File, Inc., 460 Park Ave. South, New York NY 10016; price $35.00).

Most encyclopedias present information in a sequence determined alphabetically, in accordance with topic headings which, one hopes, divide the information a reasonably un-divisive manner. On the other hand, there is an encyclopedic ideal, in which the information presented is organized in a manner that accords with the relationships inherent in the body of knowledge being presented. The editors of **Musical Instruments of the World**, to their credit, seek to follow the latter approach. They present a liberal helping of instrument types from around the globe, in a sequence



Above: Stipple drawings from **Musical Instruments of the World.**

which follows the Sachs-Hornbostel system for musical instrument categorization. Then, since a single axis of interrelationship never tells the whole story, they follow with cross-referencing sections on geographical distribution and chronological evolution. Finally, there is an alphabetical index listing instruments by name at the end.

Without a doubt, the outstanding asset of the one volume encyclopedia that results is the illustrations. **Musical Instruments of the World** conveys its information more by visual means than by text. The editors have chosen to use line drawings rather than photographs, and by favoring a graphic approach which is explicit and detailed as well as attractive, they produce clear and readable delineations of essential points, free of visual clutter. Over 4,000 such drawings in all fill the pages, along with a variety of charts and diagrams. The text, meanwhile, is generally brief, the bulk of it consisting of quick general introductions to various categories, followed by concise paragraphs keyed to the drawings of specific instruments.

The drawings make the book great for inspirational browsing. Flipping through the pages fills the imagination with possibilities and makes the page-flipper, if he or she is at all suggestible,

(continued from left)

have holes, through which cords are passed for hanging the instrument when played.

The sound is pretty awe-inspiring. For one thing, it rings and rings for over a minute after striking. Granted that's not temple bell length, but it compares to a good grand piano. When struck with a heavy mallet, the whole thing contorts as sound waves develop and collide like TV sets on a trampoline. Hard sticks are equally effective: the mass of the instrument allows loud strokes to dissipate quickly, and individual sounds remain clear. Bowed sounds have a particularly eerie quality, due to the sink's own natural reverberation.

The sink is heard on the following recordings:

NOISE NIGHT TELEVISION: **Episode Four: Rick Sanford** Public Access Channel 25, San Francisco.

R. Sanford and D. Brown: **Time and Time Again** AUC Compilation #3, Subelecktrick.

want to go out and make something. The major drawback of the Diagram Group's approach is that it is expensive to produce and requires a lot of space. The result is that their product is less complete -- which is to say, describes fewer instrument types in total -- than the two other resources discussed below. It should be noted, too, that **Musical Instruments of the World** does poorly with contemporary instruments. Steel pan does appear, various electrophones appear, one Baschet instrument can be found, but very little else arising since the turn of the century is there. Before voicing any conspiracy theories, we should allow that this absence may be the result of an editorial decision not to include instruments that have not found their way into widespread use.

Musical Instruments: A Comprehensive Dictionary, by Sibyl Marcuse (Paperback edition published in 1975 by W.W. Norton & Co., 500 Fifth Ave., New York, NY 10110.

Sibyl Marcuse's **Comprehensive Dictionary** is indeed more like what we normally associate with the word "dictionary." The body of the book is an extensive alphabetical listing of the world's musical instruments, augmented by a relatively small number of definitions of related terms. There are no illustrations. Most of the entries are as concise as possible, using abbreviated language and covering only a few lines. The great advantage of this approach is that it allows Marcuse to fit definitions of a huge number of instruments into a single volume of moderate size and cost. It is fairly rare to come across an instrument name in other literature that is not defined here.

As one might expect, it is sometimes difficult to conceptualize the instruments included based on brief verbal descriptions, although Marcuse does manage to pack a lot of information into a small space.

To balance this, a minority of entries are accorded longer essays, ranging up to five or six pages for items like violin, organ and piano. A quick assessment of these space allotments reveals a bias if favor of European instruments. This may simply reflect the greater volume of available scholarship for European instruments, especially prior to the early 60s when the first edition of the dictionary was compiled.

Another seeming bias: once again, twentieth century instruments are curiously under-represented here. While the dictionary's great strength lies in the fact that it is admirably thorough in listing little-known traditional instruments and invented instruments from the past, even some of the most prominent twentieth century explorations are omitted. Neither Partch nor Russolo, for instance, seem to have a place in this world.

The New Grove Dictionary of Musical Instruments, edited by Stanley Sadie (published in 1984 by Grove's Dictionaries of Music Inc., New York; price $350.00).

The best, and the most expensive, has been saved to the last. **The New Grove Dictionary of Musical Instruments** is a three volume encyclopedia -- over 2700 pages in total -- covering the world of musical instruments past and present more completely by far than other works. The number of entries included is huge, and the average space allotted per entry is very substantially more than the other dictionaries. Related topics such as individual builders and firms, performance practice, or various aspects of musical acoustics, are also included. Most of the longer entries are illustrated with photographs, reproductions of paintings, or whatever else elucidates the subject.

This dictionary was assembled by the same people who put out the Grove Dictionary of Music and Musicians, the twenty volume work that has been a staple of music libraries for years. The two dictionaries are both edited by Stanley Sadie, and indeed many of the entries in the Dictionary of Musical Instruments are taken, either directly or with additions and changes, from the Dictionary of Music and Musicians. Sadie and the New Grove organization have the wherewithal to enlist the services of the most knowledgeable authors, and the list of contributors for the musical instruments dictionary runs to eight pages and includes a lot of respected names.

The coverage of new instruments in the **New Grove Dictionary of Musical Instruments** is excellent. A goodly amount of space is devoted to experimental builders from around the world, and a fair sample is included of those whose work had had an impact beyond their immediate circle prior to the 1984 publishing date. There are extended articles under the headings Sound Sculpture, Electronic Instruments, and Microtonal Instruments. Most of the material on new instruments was penned by Hugh Davies, an instrument builder and scholar from London, and, it is probably safe to say, the best qualified person for the task. Practical constraints did lead the editors to put some restrictions on the dictionary's coverage of new instruments, as they surely had to do in other areas as well, but, judging from the final results as well as Mr. Davies' own comments, most of the substance seems to have come through reasonably intact. Taken as a whole the several entries stand as the most comprehensive discussion of 20th century experimental instrument building available.

The price puts this work out of the reach of most individuals. My impression is that many libraries have been slow to pick up on it, perhaps for the same reason. The result is that it is a difficult resource to get hands on. EMI has a copy, acquired at a cost of nearly twenty subscribers' worth of income. Since it appeared in our humble library it has become by far the most commonly used reference.

RECORDINGS

SHORT REPORTS

Here are brief descriptions of four LPs of potential interest to EMI readers. All are somewhat old releases which never got mention in EMI when they were new. With the exception David Cope's piece (which is a bit less abstract in its aesthetic), these records are primarily about sound for sound's sake -- invitations to greater sound awareness, perception and attention.

THE WAY / CONCERT, David Cope.
LP on Opus One (Box 604, Greenville, Maine 04441) 1982.

The first 15 minutes of side one of this record is a recording of **The Way**, comprising four movements of a projected much longer work for voice and over two hundred instruments, most of them made specifically for this piece. **(Concert**, filling the remainder of the LP, is a piano concerto and not of primary interest here.) In its inspiration, **The Way** is based in Navaho culture and the Arizona canyon country. The piece is performed by the composer alone, with the instruments arrayed before him in a 6'x 6'x 8' frame. They are generally simple and crudely made ("I am not an instrument builder, but rather a builder of works," says Cope). Included in this recording are, among others, panpipes, a glass harmonica, pianoharp, gongs, an altered pump organ, music box, automobile horns, chimes, and springs. The voice is often masked by speaking through horns.

The piece has a peculiarly distant, veiled, and yet emotional, quiet, wailing quality.

LAMENT FOR THE RISE AND FALL OF THE ELEPHANTINE CROCODILE, by Yoshi Wada.
LP on India Navigation (distributed by New Music Distribution Service, 500 Broadway, New York, NY 10012), 1982.

The Elephantine Crocodile is a bagpipe, with a big, beastly-looking bag that lies on the floor, supplied with air by a compressor. It has seven reed pipes of up to about five feet high, rising from what looks much like a yawning hippopotamus mouth at one end. The Alligator is a similar instrument, but distinctly more reptilian in appearance, and without the pipes -- apparently it uses pipeless free reeds. The two are used for very long, sustained tones, precisely tuned with the overtone series in mind.

This recording was made in a highly reverberant empty swimming pool. The first side is devoted entirely to Wada's solo vocalizing, in which he explores the overtone series both through the use of vocal harmonics and as scale material for vocal fundamentals. On side two we hear the bagpipes in ceaseless, edgy droning which encourages the listener to examine the acoustic effects of pitch relationships of the pipes and their prominent overtones. To this Wada intermittently adds sustained vocals which explore the harmonics of a single tone.

A second Elephantine Crocodile LP by Yoshi Wada has appeared on India Navigation since this one was made.

GLASS WORLD OF ANNA LOCKWOOD, by Anna Lockwood.
LP on Tangent Records (Suite 11, 52 Shaftsbury Ave., London, W1, England; also available through NMDS, address above), 1970.

This record is an exploration of the great diversity of sounds one can produce with glass. Unlike the music of Toronto's Glass Orchestra, (which came into being a few years after this recording was released), the glass sounds here are not organized into compositions, but simply presented as individual sounds, musical in themselves. Sounds recorded here include: the bending tone of a square pane of glass struck like a gong and dipped into water; the long, snaky rattle of a glass rod held flat against a pane with some overhang, pulled away and allowed to snap back and buzz its energy away; the sustain of a suspended pane bowed along the edge with a glass rod; the wobble wobble sound of larger panes flexing; the cry two pieces rubbed together; and percussion sounds tiny & tinkly and big & booming.

NODAL EXCITATION, by Arnold Dreyblatt
LP on India Navigation (distributed by New Music Distribution Service, address above), 1982.

At the heart of the Orchestra of Excited Strings, for which this work is scored, are double basses re-strung with unwound steel wires. They are played primarily by tapping the strings with the wooden part of the bow while touching nodal points to isolate particular overtones. Three more instruments join the basses to reinforce selected overtones: first, a midget upright piano which has had the felts replaced with harder, sharper striking surfaces and the strings replaced with thick steel wires; second, a copy of a fourteenth century hurdy gurdy; and third, a homemade portable pipe organ with a keyboard designed to reflect the group's tuning system, based on odd-numbered harmonics and their odd-numbered multiples.

The bass bonging dominates the group's sound. It is a continuous pulse running through both sides of the record, at slightly varying tempos in the vicinity of mm = 120. The fundamental remains quite prominent, Jew's harp style, despite the harmonics fingerings, and non-harmonic striking noise is also quite pronounced. The harmonics, which require some initial effort on the listener's part to isolate and follow, are a fine, quiet ringing, creating a slow moving melody over the fundamental. This is very repetitious music.

eXPERIMENTAL mUSIC pUBLICATIONS

Balungan, a publication of the American Gamelan Institute. Information on all forms of gamelan, Indonesian performing arts, and related developments worldwide. Subscription (three issues) $12 individual, $16 foreign, $20 institution. Archives Distribution Catalog, listing tapes, monographs, scores, and videos, $2. Box 9911, Oakland CA 94613. (415) 530-4553.

Frog Peak Music (A Composers' Collective). Publishes and distributes experimental artist-produced books, scores, tapes, and innovative music software. Catalog on request. Box 9911, Oakland CA 94613. (415) 530-4553.

Musicworks: The Canadian Journal of Sound Explorations. Journalistic and audio perspectives on all aspects of music and music-making. Subscription (3 issues annually) $26, includes cassettes. Sample issue (28 pages) with 60 min. cassette, $8.75. 1087 Queen St. West, Toronto, Canada M6J 1H3. (416) 945-4458

1/1: The Quarterly Journal of the Just Intonation Network, David B. Doty, editor. Serves composers, musicians, instrument designers and theorists working with tunings in Just Intonation. One year membership includes subscription. Individual, $15 US, $17.50 foreign; institution $25. 535 Stevenson St., San Francisco CA 94103. (415) 864-8123.

Experimental Musical Instruments. Bimonthly newsletter and yearly cassette documenting new acoustic and electroacoustic sound sources. Subscription $20/year, tapes $8.50 general, $6 to subscribers. Sample issue on request. PO Box 784, Nicasio CA 94946.

Soundings Press. Since 1972 Soundings Press has published an annual anthology of scores and articles by today's young composers, and composers active earlier in the century: Nancarrow, Harrison, Bowles, Cowell, Partch, Revueltas. The radical edge of contemporary American music. Free 16-page catalog upon request. PO Box 8319, Sante Fe NM 87504.

NOTICES

SOUND ARTS, a juried and invitational exhibit at Vista Fine Crafts, August 19 - Sept. 9, 1989. Eligible: All craft artists who work in musical instruments (both traditional and experimental), bells and chimes, or anything that makes music or sound. Jurors: Sherrie Posternak and Sam Rizzetta. No entry fee. 40% commission taken on sales. Insured while on site. Send 3-5 photos or slides (with descriptions and price range), plus resume. Deadline: June 1. For application or more information send SASE to Sherrie Posternak, Vista Fine Crafts, PO Box 2034, Middleburg, VA 22117; phone (703) 687-3317.

TONY WELLS, musician and collector of eclectic instruments and music styles, including Waterphones, Tibetan Singing Bowls, Flutes and effects, presents two cassette albums. Approximately one hour each in length, COLLAGE and WEATHERSPACE are available for $10.00 each, plus $1.00 for shipping and handling to Karma Productions, 701 Bush St., Las Vegas, NV 89107. (702) 870-8749. Also available for live performance. Send $2.00 for sampler tape.

JUST INTONATION CALCULATOR, by Robert Rich. Macintosh Hypercard stack makes JI easy: shows scales to 48 notes/octave; calculates transpositions; reduces fractions; converts between ratios, cents, DX7II, TX81Z units; internal sound. Only $10.00. Soundscape Productions, Box 8891, Stanford, CA 94309.

MINNIE BLACK'S GOURD BAND on video! 29 minutes, directed by Anne Johnson, 1988. Available from Appal Shop Marketing and Sales, 306 Madison St., Whitesburg, KY 41858.

The long awaited recording by MUSIC FOR HOMEMADE INSTRUMENTS is almost upon us. Scheduled for release sometime in March, available for $6 from MFHI, 262 The Bowery, New York NY 10012. Also: Skip La Plante of MFHI will lead an instrument building session under the auspices of The Learning Alliance on April 1, 1-4 pm, at 262 The Bowery in New York. Call the Learning Alliance at (212) 473-3689 for information.

EMI BACK ISSUES: Back issues of Experimental Musical Instruments numbered Volume III #1 and later are individually available for $3.50 apiece. Earlier issues available in volume sets, photocopied and bound: Vol. I #1-6, $14; and Vol. II #1-6, also $14. Order from EMI, PO Box 784, Nicasio, Ca 94946, or write for complete listing. Corresponding cassette tapes also available for each volume; see information below.

CASSETTE TAPES FROM EMI: From the Pages of Experimental Musical Instruments, Volumes I, II and III are available from EMI at $6 apiece for subscribers; $8.50 for non-subscribers. Each tape contains music of instruments that appeared in the newsletter during the corresponding volume year, comprising a full measure of odd, provocative, funny and beautiful music. Order form EMI, PO Box 784, Nicasio, CA 94946.

RECENT ARTICLES, continued from page 24

THE CONSTRUCTION AND USE OF THE KNOBBED GONG IN TAIWAN by Han Kuo Huang, in **Balungan** Vol. 3 #2, Oct. 1988 (Box 9911, Oakland, CA, 94613).

This article provides background information on gongs and their use in Taiwan, describes Taiwanese gongs and contrasts them with the more familiar Javanese gong types, and describes their construction process as practiced by the leading gong manufacturer in Taiwan.

AN INTRODUCTION TO THE SLENDRO GENDER PANERUS INCLUDING CENGKOK NOTATION by Marsudi, translated by Kent Devereaux, in **Balungan** Vol. 3 # 2, Oct. 1988 (address above).

A review of the gender panerus (Indonesian metallophone), including a detailed look at its construction.

American Lutherie Number 16, Winter 1988 (8222 S Park Ave., Tacoma, WA 98408) contains articles from makers of mandolin, fiddle, lute, and guitar. Also included:

WORLD FOREST OUTLOOK, by Nicholas Von Robison and Parry Thomas, PhD, discusses the prospects for future supplies of tropical hardwoods used in instrument making.

SOUND RADIATION FROM GUITARS by Dr. Thomas Rossing expands on a previously described model for guitar sound propogation, addressing along the way various interesting related questions, such as "what constitutes good tone?" Much of what is said applies as well to other string instruments of similar sound box construction.

BASS STRING UPDATE, by Frederick C. Lyman, Jr., describes the results of an effort by the D'Addario string manufacturing company to manufacture a synthetic bass string with the playing qualities of traditional gut. A new tungsten bass string is also reviewed.

Ear Magazine Vol. 13 #10, Feb. 1989 (325 Spring St. Rm 208, New York, NY 10013) is subtitled "Noise #2." It follows up the last issue's essay on noise music with interviews and reports on several practitioners of the art.

GEORGE CISNEROS, on the "New Faces" page, is a one page piece comprised of a photo and quotes from Cisneros, new music activist and maker of sound sculpture in Texas.

RHYTHM AND NOISE: SOUNDS FROM THE SLAG HEAP, by Suzanne Stefanac, is an interview with members of Rhythm and Noise, a San Francisco group working with highly dissonant sound sources (many of them taken from the slag heap, but with a lot of computer-controlled electronic manipulation) in imaginative and challenging performance situations.

MARYANNE AMACHER: ARCHITECT OF AURAL DESIGN, by Leah Durner, discusses Amacher's efforts in applied psychoacoustics. She works with spatial sound imaging, combination tones, aftertones (meaning sounds retained in the brain after ceasing to sound physically), sounds displaced from one environment to another, and the use of architectural structures for sound transmission.

BORBETOMAGUS, by Neil Strauss, is an interview with members of the group Borbetomagus. They work with altered and misused guitars and saxophones in improvised performance situations.

BENOIT MAUBREY, DRESSED TO SHRILL, by Charles S. Russell, reviews Benoit Maubrey's work with sonic clothing -- outfits which are outfitted with speakers and such. Several pages of photos are included.

FESTIVALS, by several authors, reviews three more or less recent music festivals. Two of these held special interest for EMI readers: **ARS Electronica** in Linz, Austria (Sept. '88), included performances by several important European sound artists and groups, with lots of interesting and imaginative electronic and electroacoustic explorations. **Sound Symposium**, at St. John's, Newfoundland (July '88), mixed traditional music styles, both local and exotic, with work by several American and Canadian contemporary sound explorers. Included were several environmental sound works, taking place in an already aurally engaging natural environment.

RECENT ARTICLES IN OTHER PERIODICALS

Following here are selected articles relating to unusual musical instruments which have appeared recently in other publications.

1988 ANNUAL REPORT, by Ivor Darreg (3612 Polk Ave., San Diego, CA, 92104).

Ivor Darreg, microtonalist, instrument maker and theorist, has put together this 55-page review of his musical activities during the past year. Included in this year's report are discussions of improved networking connections, other recent publications and recordings by Mr. Darreg, musical instruments and electronic equipment, scale systems, future directions for contemporary music, the intractability of the music establishment, and various angles on the peculiar suchness of life.

Also recently published by Ivor Darreg: "Don't Fence Me In," a pamphlet on the importance of breaking the dominance of 12 tone equal temperament if music is to be free to progress in certain ways.

1988 SWAMPBOOK, "the vastly revised & thoroughly annotated interdactyl resource", published by Xexoxial Endarchy (1341 Williamson St., Madison, WI 53703).

A photocopied booklet of after-the-fact program notes for the 3rd Annual Innergalactic Festival of the Swamps, held in Madison, Wisconsin, Aug. 25-28, 1988. The booklet is filled mostly with colorful, sometimes esoteric comments from participants. The festival, which appears to have been a wonderfully bizarre event, included a lot of sound exploration, such as public sound sculpture jams. Several photographs (not very clearly reproduced) are included. The next Festival of the Swamps is scheduled for Aug 23-27, 1989 in Madison.

JANUARY IS A GREAT MONTH TO MAKE MUSICAL INSTRUMENTS, in **Sesame Street Magazine** January/February 1989 (PO Box 55518, Boulder CO 80322-5518).

This issue of **Sesame Street Magazine** (brought to you by the number 10) is subtitled "Learn About Sounds." Among several sound-related features is the article mentioned here, containing instructions for making a cardboard tube & wax paper kazoo, and a shoebox banjo with rubber band strings.

CALFSKIN: THE ENDANGERED MEDIUM by Gary Cook, in **Percussive Notes** Vol. 27 #2, Winter 1989 (123 W Main St., Box 697, Urbana, IL 61801-0697).

A discussion of the use of natural hide for timpani drumheads -- their pros and cons (mostly pros), their availability, some history, and information on the process of manufacture. Good follow up reading for those interested by EMI's recent more general feature on membranes.

INSECT ORCHESTRAS, in the "For Younger Readers" Section of **Sierra Magazine** Vol. 73 #5, Sept. - Oct. 1988.

The sound-producing methods of crickets, cicadas, death's-head hawkmoths, leafcutter ants and cockroaches, explained through using musical instrument analogies.

Glass Music World Vol. 3 #1, January 1989 (2503 Logan Dr., Loveland, CO 80538), covers the events of the Glass Music Festival that took place in Corning, New York, October 12-16, 1988. Included are discussions and lots of photographs of glass instuments both familiar and exotic.

Newsletter of the American Musical Instrument Society Vol. XVII #3, October 1988 (c/o Shrine to Music Museum, 414 E. Clark St., Vermillion, SD 57069-2390) contains brief notes on or photographs of several interesting instruments, including photographs from the Musikinstrumenten-Museum in Berlin, an exhibit of historic double reeds in Victoria, BC, and the Folk Music Center in Claremont, CA.

FROM HUGO BALL TO HUGO LARGO by Mark Dery, in **High Performance** #44, Winter 1988 (240 S Broadway 5th Floor, Los Angeles, CA 90012).

A review of the common ground between "performance art" and popular music. Christian Marclay (record turntable wizard), Laurie Anderson, Luigi Russolo and miscellaneous other sound experimenters are mentioned.

ARE BRASSWINDS OVERPRICED? in **The Music Trades**, Vol. 137 #1, January 1989 (80 West St., PO Box 432, Englewood, NJ 07631); no author credited.

Music Trades often publishes articles which appear to be promotional pieces for various manufacturers. Commercially motivated or not, they are often excellent articles with lots of information and good, informative photographs. This one, a tour through United Musical Instruments' Eastlake, Ohio factory, will convince you that brasswinds are not overpriced.

BURNISHING WURLITZER'S RICH HERITAGE in **The Music Trades** Volume 136 #12, December 1988 (address above); no author credited.

Another example of the genre described above. It is perhaps less interesting from EMI's point of view, being more concerned with company history and marketing strategies, but nonetheless contains informative photographs of piano manufacturing operations within the factory.

(more on page 23)